

GENERAL NOTES

OBSERVATIONS OF HILLTOPPING *MITOURA SPINETORUM* AND *M. JOHNSONI* (LYCAENIDAE) IN CALIFORNIA

Mitoura spinetorum (Hewitson) and *Mitoura johnsoni* (Skinner) are medium-sized hairstreak butterflies having broad distributions but low-density and sometimes localized populations. These closely related species have similar reproductive biologies, and both use hilltopping behavior as a mate-locating strategy. Past observations of hilltopping behavior by these species are summarized, and new observations of some California populations are presented.

Previous reports of *M. spinetorum* behavior include hilltopping by males in the Providence Mountains, San Bernardino County, California, and Black Ridge, Mesa County, Colorado (Shields, 1965, J. Res. Lepid. 4:233-250); hilltopping by both sexes in the eastern Mojave ranges (Emmel & Emmel, 1973, Butterflies of Southern California, Nat. Hist. Museum Los Angeles Co., Science Series 26:1-148); perching on small pines near hilltops in Grand Canyon, Arizona (Scott, 1973, J. Lepid. Soc. 27:283-287); and perching by males on ridgetop pinyons and junipers in Nevada (Austin & Austin, 1981, J. Res. Lepid. 19:1-63). Shields (in Scott, 1973) observed *M. johnsoni* males perching on the tops of tall trees on a hilltop next to Thompson Canyon, Yolo County, California.

Our observations of hilltopping adults were made at two locations in the Inner Coast ranges of California: North Peak (1080 m) of Mt. Diablo in Contra Costa County and a ridge (310 m) at Butts Canyon in Napa County. Digger pine (*Pinus sabiniana* Douglas) and California juniper (*Juniperus californica* Carriere) occur in a semi-open area on the summit of North Peak. Only one conifer, digger pine, grows on the ridgetop at Butts Canyon in serpentine chaparral. Digger pine is commonly parasitized by pine dwarf mistletoe (*Arceuthobium campylopodum* Engelm.), the larval host plant of *M. spinetorum* and *M. johnsoni* in the study areas. *Mitoura spinetorum* occurs at both North Peak and Butts Canyon; however, *M. johnsoni* has been found only at the latter location.

Mitoura spinetorum appears to have three broods on North Peak. Adults have been found at this location from late March to early May, June to early July, and mid-August to late September (Opler & Langston, 1968, J. Lepid. Soc. 22:89-107; our observations 1975-1981). At Butts Canyon, adult *M. spinetorum* and *M. johnsoni* have been found in March, April, and June (Langston, pers. comm.; our observations, 1981). Although no late-season individuals of either species have been encountered at this site, it seems likely that at least *M. spinetorum* has a third emergence at Butts Canyon.

On North Peak, *M. spinetorum* males perch on the needles and occasionally on staminate cones of digger pine and foliage of junipers growing about the summit and nearby ridgetops. Some of these trees appear to be more often used for perching than others, as adults have consistently been found on the same conifers over several seasons. Trees used for perching are not necessarily the tallest present, may or may not have mistletoe, and are always located on a ridge crest but not necessarily at the highest point. At Butts Canyon, male *M. johnsoni* perch mostly about the tops of digger pines approximately six meters in height. Many of these trees are infested with pine dwarf mistletoe, some heavily.

Mitoura spinetorum males perch by alighting for periods of up to 35 minutes during which they may wave the antennae, rub the hindwings together, shift body orientation, or remain motionless. Males fly from perching sites to investigate conspecific males and other insects (lycaenids, hesperiids, and dipterans), to circle erratically about the perching site, or to transfer to other perching sites. One *M. spinetorum* was continuously engaged in these activities from 0920 to 1105 hours PST (Sept.) on North Peak. *Mitoura johnsoni* males exhibit similar perching behavior.

¹ Records of Clark County, Nevada *M. spinetorum* supplied by an anonymous reviewer also show a disproportionate sex ratio at hilltops (24 males, 0 females) and at canyon bottoms (4 males, 11 females).

Females were seen at our study sites only a few times. On 4 April 1981 two mating pairs of *M. spinetorum* were found on North Peak. Both were on trees frequently used by perching males. One pair was resting on juniper foliage, the other on a staminate cone of digger pine. Occasional North Peak females were seen flying about pine dwarf mistletoe on a ridgetop near the summit. Although no mating *M. johnsoni* were found at Butts Canyon, several ovipositing females were observed on the ridgetop in April. The disproportionate sex ratio at the ridgetops and summit may indicate female dispersal after mating.¹

These observations are consistent with Shields' (1967, J. Res. Lepid. 6:69-178) and Scott's (1970, J. Res. Lepid. 7:191-204) conclusions that butterflies with low population densities hilltop in order to facilitate the rendezvous of mates.

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LEPIDOPTERA REARED ON A SIMPLE WHEAT GERM DIET

Artificial diets have been used as food in rearing many species of Lepidoptera (Singh, 1972, Bull. N.Z. Dept. Scient. Ind. Res. 209 pp.; Vanderzant, 1974, A. Rev. Entomol. 19: 139-160; Hinks & Byers, 1976, Can. Entomol. 108:1345-1357). They may be synthetic (meridic), or composed of one or more natural products (oligidic) such as wheat germ and homogenized beans. The latter type is especially useful in rearing the larvae of polyphagous species of Lepidoptera, since no specific phagostimulants are required.

Fifty-seven species of Lepidoptera, mainly Noctuidae but also Lymantridae and Geometridae (Table 1), were reared from egg to adult on a simple wheat germ diet from 1977-1980. Adult females were collected at either a 15 watt ultraviolet light or sugar bait. Females thus collected were placed in 10 × 6 × 2 cm clear polystyrene boxes and fed a 10-15% sucrose solution until eggs were laid.

Larvae of all species were fed an artificial diet based on that of Hinks and Byers (1976), except that kidney beans were used instead of pea beans. An additional 100 g of wheat germ and 12 ml of formaldehyde were also used. The formaldehyde had no effect on the growth of any species of Lepidoptera bred, although it is known to have an inhibitory effect on the growth of other kinds of insects (Singh & House, 1970, J. Insect Physiol. 16:1969-1982).

Rearing techniques followed those developed by Hinks and Byers (1976) for the genus *Euxoa*, except that larvae were reared in 10 × 6 × 2 cm clear polystyrene boxes, with 15-20 larvae/box. At the fourth instar the larvae were separated and reared to maturity individually in 15 × 100 mm disposable polystyrene Petri dishes. All larvae were reared at 25-30°C under a photoperiod of 15-9 h light-dark cycle.

Feeding was discontinued at the first visible signs of the prepupal period, and 5-10 larvae were placed in 946 ml polystyrene containers partially filled with moist, sterilized top soil. A strip of paper towel provided a vertical surface for the moths to crawl up upon emergence. The containers were sealed with clear polyethylene and were kept at the same temperature and photoperiod conditions as the larvae.

Newly eclosed larvae of two noctuid species, *Feralia comstocki* Grt., a general feeder on coniferous trees, and *Homorthodes furfurata* (Grt.) which has been recorded from *Acer* spp. (Rockburne & Lafontaine, 1976, The Cutworm Moths of Ontario and Quebec.